

Marked-Up Version of Substitute Specification

Docket No. 3926.154

Patent Application

METHOD AND DEVICE FOR OPERATING
A NIGHT VISION SYSTEM FOR CARS

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application is a national stage of PCT/EP2003/011517 filed October 17, 2003 and based upon DE 102 49 816.4 filed October 24, 2002 under the International Convention.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The invention relates to a method for operation of an automobile night vision system, and to an apparatus for use of the method for operation of an automobile night vision system.

Description of Related Art

[0003] Poor visibility at night is a stress-creating and dangerous situation in road traffic, which is feared by many drivers. As a consequence of poor visibility, the accident probability at night is considerably higher than when driving in the daytime and in good visibility. In the future, automobiles will be equipped with night vision systems in order to improve road traffic safety. The night vision systems which will be used for this purpose normally operate in the near infrared wavelength band (NIR). Since the radiation from the NIR headlights which are used in conjunction with automobile night vision systems is invisible to the human eye, this represents a danger against which people must be protected. However, protection against the NIR radiation is only one reason why night vision systems can be operated only in very specific conditions.

[0004] A system for assisting the driver's visual capabilities when driving at night is proposed on the Toyota Motor Corporation Internet page www.toyota.co.jp/Showroom/Alltoyota_lineup/LandCruiserCygnus/safety/index.html. When dipped headlights are switched on, the system shows the road profile, which is difficult to see in front of the light beam of

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the vehicle, and the objects located in the surrounding area. The system also provides assistance to long-distance vision, in particular in situations in which it is impossible to drive on main beam. In this case, the night vision system uses invisible near infrared rays, which are not perceived by the human eye. The energy, which is invisible to the human eye, is recorded by an IR camera fitted in the vehicle, and is processed to form an image. The processed image is then projected by means of a head-up display onto the vehicle windshield.

SUMMARY OF THE INVENTION

[0005] For safety reasons, the "Night-View" system must not be used as the sole source of vision. The system safety can in this case be adversely affected by a large number of factors, such as rain, a dirty windshield, poorly reflective clothing, etc.

[0006] Furthermore, there is the possibility of danger to people in the vicinity of the vehicle as a result of the invisible radiation from the IR illumination, for which reason the infrared transmitter should not be looked at for a lengthy period from short range.

[0007] The following operating conditions must therefore be satisfied at the same time for operation of the night vision system: ignition ON, surrounding area dark, headlights ON, night-view switch ON, and furthermore the speed of travel must be at least 30 km/h. The disadvantage in this case is that the system cannot be designed to be flexible, and cannot be operated such that it is adapted to different situations.

[0008] The invention is thus based on the object of providing a novel method for operation of an automobile night vision system, as well as an apparatus for use of the method as claimed in the precharacterizing clauses of patent claims 1 and 10, which allows the night vision system to be designed to be flexible, and allows the system to be operated such that it is matched to different situations.

[0009] According to the invention, the object is achieved by a method and an apparatus having the features of patent claims 1 and 10. Advantageous refinements and developments of the invention are specified in the dependent claims.

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[0010] According to the invention, a night vision system is operated on a vehicle. The night vision system in this case has an illumination unit for transmission of infrared radiation, by which means the surrounding area in front of the vehicle is preferably illuminated. The infrared radiation which is reflected on the road surface and on other objects is detected by means of an image recording unit which is sensitive to the infrared wavelength band. An image processing unit is provided for evaluation of the detected data from the surrounding area. In this case, the purpose of the image processing unit is not only to convert the data from the surrounding area to an image, but also to allow object identification to be carried out.

[0011] The components of the night vision system can be driven individually in a particularly advantageous manner by means of at least one control signal. In this case, the control signal may, for example, be a control signal which is generated by an image processing unit, by an image recording unit, by further vehicle-internal systems or by user inputs (for example by means of a pushbutton or foot-operated switch). It is thus possible to operate the individual components of the night vision system in different constellations. The invention therefore also for the first time makes it possible to operate the night vision system such that it is flexibly matched to different situations. In this case, all of the operating conditions need not necessarily be satisfied at the same time for operation of the individual components of the night vision system in different constellations.

[0012] In one embodiment of the invention that results in an improvement, an optical display is provided as an additional component for the night vision system. The optical display is used primarily to display information from the surrounding area detected by means of the IR camera. The optical display furthermore makes it possible to display other information produced by the image processing unit, as well. For example, this may be image data which represents object data or distance data. The optical display can be designed to be a head-up display in this case. An embodiment is also feasible in which a display is integrated in the vehicle cockpit, for the optical display.

[0013] In a further embodiment of the invention which results in an improvement, the night vision system is additionally equipped with an interface. The night vision system can

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interchange information with vehicle- internal systems via the interface. In this case, on the one hand, vehicle-internal systems can activate the components of the night vision system while, on the other hand, individual components of the night vision system can also transmit control signals to vehicle-internal systems.

[0014] By way of example, a navigation appliance which is fitted in the vehicle can activate the night vision system automatically at the appropriate time when the vehicle is approaching a tunnel, and shortly before driving into the tunnel, on the basis of information from digital maps.

[0015] The image data which is detected by means of the camera of the night vision system (with the camera advantageously being located in the area which is cleaned by the windshield and/or headlight cleaning system) can be evaluated in order to detect dirt on the windshield or headlights, and then to transmit a control signal to the control unit for the windshield and headlight cleaning system, and to activate the headlight cleaning system. The

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